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ABSTRACT

Details of a computer-assisted instruction program in chemistry are given. Approximately half of the instructional computer usage is centered around drill, tutorial, and simulation programs. Problem solving, including research, and programming courses constitute the other half. Also described is a computerized system available to the chemistry faculty that generates examinations from an item pool, grades the examinations, and prepares a statistical analysis of the examination questions, answers, and scores. (MH)

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COMPUTER ASSISTED INSTRUCTION AND COMPUTER TEST CONSTRUCTION IN CHEMISTRY AT MIDDLE GEORGIA COLLEGE*

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Since 1972 the Chemistry Department at Middle Georgia College has been using an interactive computer to supplement its traditional curricula. (Interactive means that you can converse with the computer. This is usually done with a typewriter.) To better understand our attempts in this area, some background information should be mentioned. Middle Georgia College is one of thirty-two institutions which make up the University System of Georgia. The University System has 130,000 full time students, 1500 of which attend Middle Georgia College. A central site known as the Office of Computing Activities (OCA) operates a CDC CYBER 70, Model 74 computer, two IBM 370/158 computers (each with approximately 2-6 million bytes of core storage), and other hardware. These facilities are accessible in batch or interactive modes by thirty-three institutions which comprise the University System Computer Network (USCN). (Batch usually refers to the process where one gives the computer a problem and returns for the solution at a later time.) Most of the USCN schools have their own computer facilities which have both stand alone capabilities (the ability to work independently of a larger computer) and the capability to interact with

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the central computer hardware. Some of the schools in the USCN only have teletype terminals (typewriters) serviced by the Network computers. At Middle Georgia College we have three interactive computer terminals used to assist with instruction and a small computer (IBM System/3) serving the administrative needs. We are planning to build a larger computer center which will serve both academic and administrative needs.

Approximately half of the instructional computer usage at the central site is centered around drill, tutorial, and simulation programs. Problem solving (including research) and programming courses consititute the other half.

Each institution in the University System has a Network Computer Coordinator. When I was asked to be the Computer Coordinator at Middle Georgia College in 1973, the offer was accepted without a teaching load reduction or a salary increase. It was not a popular job. I was the fifth person to assume the duties in the four year history of the position. In the fall of 1976, after three years as Computer Coordinator (a new endurance record), I requested a reduction in my teaching assignment. This was subsequently granted. The situation is now ideal. I have time to do what I feel to be the most important job of a Computer Coordinator, that of increasing the school-wide usage of the computer as an educational tool by making faculty members aware of the material available to them and to their students.

We have over four hundred Computer Assisted Instruction (CAI) programs in our public libraries (a public library's contents are available to the entire Network and maintained by the OCA).

These four hundred computer tutorial programs represent over twenty content fields including chemistry, sociology, political science, mathematics, biology, business, medicine, computer programming, foreign languages, and physics. We are presently evaluating each of these programs and demonstrating them to appropriate faculty members. This project was initiated ten weeks ago and is doing very well. We are emphasizing to the faculty that no knowledge of computers is required to make use of the lessons. We have student aides available forty hours a week to help students and faculty operate the hardware and assist with any problems that may arise.

Our experience indicates that the most effective way to increase faculty usage is to have an individual meeting with each faculty member. It is usually a waste of time to rely on mimeograph handouts and announcements at faculty meetings to accomplish this task. It is important to stress the small amount of effort that is required of the faculty to enable their students to benefit from this educational tool.

The OCA has installed MULTITUTOR (a CAI authoring language) which gives more ambitious faculty members the capability to author their own tutorial programs. MULTITUTOR utilizes many features of the PLATO IV language, TUTOR, while requiring only conventional terminals to author and execute CAI lessons. MULTITUTOR appears to be a logical first stage for institutions interested in eventually adopting PLATO because lessons written in MULTITUTOR are compatible with the PLATO system.

In the fall of 1976 the OCA announced the availability of a computer assited test construction system (TCS) that would be available to the thirty-three institutions in tne USCN. An initial package of 50,000 items (examination questions) was presented to us free of charge by the University System of California Project SOCRATES. The present status of the California project is unknown. According to some reports it may have been abandoned when funding stopped.

Some problems have developed and our TCS system is still not being fully utilized. However, I can tell you what is available and of the exciting potential uses. I am also here to offer you the TCS software and data files (the 50,000 items) if you are interested in setting up a similar system on your own campus.

TCS provides a means for faculty to construct examinations from large data files of text items (over 50,000 and growing). Typical of the eighteen subject areas represented are chemistry, accounting, astronomy, biology, business, data processing, economics, history, marketing, mathematics, physics, and psychology.

You may dislike the idea of a computer generating your examinations. You may feel that you can write better examination questions for your own students than a computer can. But TCS examination questions are not written by a computer. The questions are written by your peers. The computer merely serves as a storage device for examination questions written and used by chemistry instructors from around the country. The TCS can be thought of as a way for faculty members from around the United States to share ideas.

In addition to generating examinations and allowing ideas to be shared, TCS can be used to prepare worksheets, homework, pretests, makeup examinations, diagnostic tests, challenge examinations, drills, and student self-paced study material. As a particular example of self-study use, we are expecting thousands of questions for nursing students to use in their preparation for the state nursing examination.

There are four indexing fields associated with each test item. These are: content category (what subject, e.g., chemistry, and what area of that subject, e.g., thermodynamics), cognitive level (recall, application, interpretation, problem solving), and item type (true-false, multiple-choice, short answer, essay).

The TCS service also provides a computer program for test scoring and analysis via optical scanners and statistical packages.

The statistical package prepares an eight page report which includes about twenty types of analysis (mean, standard deviation, reliability, standard error of measurement, summary graphs, range of scores, percentage of responces to each choice, difficulty index, discrimination index, T-Scores, raw scores, percentiles, etc.). The statistical package defines all terms used in the analysis and explains how each analysis should be interpreted. For example, the report might state: "Your standard error of measurement is 2.0549. This means that for any particular test score the odds are 2 to 1 that the student's true score (his average score on several similar tests) will not deviate from the one obtained by more than 2.0549 points. The more reliable and error-free the test, the smaller the standard error

of measurement."

Recapitulating, we have a system that (1) generates examinations, (2) grades examinations, and (3) prepares a statistical analysis of the examination questions, answers, and scores.

Dr. John Edwards of the Division of Education and Technical Support of the USCN has offered to cooperate with interested conference attendees by sharing our material (files and software) and providing technical advice. His address is: Office of Computing Activities, Graduate Studies Research Building, University of Georgia, Athens, GA 30602. The approximate cost to you would be two or three dollars to cover postage and computer time. We have estimated that four 2400 foot, 9-track tapes (standard industry compatable) will be required to store all of the material. Your institution would have to supply these blank tapes and have a computer that can read CDC format.

The current national computer cost per student per course is $25.00. (It is less than this in the USCN.) It is commonly accepted that computer costs are constantly decreasing in much the same way as the hundred dollar pocket calculator of a few years ago is selling for four dollars today. With continuously lowering computer costs, it is inevitable that computers will take an ever increasing role in education.

If you are interested in tapping this technology for your own chemistry department, your minimum need is a coordinator with release time. (As obvious as this may sound, Middle Georgia College is the only USCN institution that gives its Computer Coordinator

a course load reduction.) The position of Computer Coordinator should be filled by somebody from within the existing academic ranks (i.e., not a computer major). The person chosen for the job should be one who has demonstrated an active interest in CAI in his own area and who can enthusiastically extrapolate his experiences to assist faculty in other academic areas.